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Identification of soft competencies aspects in human resource development in the industrial era 4.0

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ABSTRAK

Penelitian ini bertujuan untuk mengetahui aspek kompetensi yang dibutuhkan pada industri 4.0. Metode yang digunakan dalam penelitian ini adalah tinjauan pustaka sistematis (Systematic Literature Review) dengan Model PRISMA dalam tahapan tinjauan pustaka. Adapun tahapan tersebut yaitu identifikasi, penyaringan, penilaian kelayakan dan inklusi. Studi awal menyertakan 284 artikel yang berasal dari database Scopus, Sciencedirect dan Springerlink serta 3 tambahan artikel berupa report article dengan rentang waktu publikasi tahun 2010 hingga 2021, yang kemudian diseleksi sesuai kriteria inklusi dan eksklusi. Terdapat 32 Artikel yang dinilai layak untuk proses analisis kualitatif lebih lanjut. Seluruh full-text dianalisis menggunakan pendekatan analisis konten dan dilakukan oleh 3 ahli. Hasil analisis menunjukkan terdapat 10 aspek soft kompetensi yang disebutkan oleh berbagai jurnal sebagai aspek yang dibutuhkan untuk mendukung Industri 4.0. Aspek-aspek tersebut adalah leadership, working with people, customer orientation, communication, task engagement & responsibility, decision making, problem solving, creative & innovative orientation, flexibility & adaptability, learning orientation, emotional resilience. Kesepuluh aspek ini kemudian dikelompokkan menjadi tiga kelompok besar yaitu Managing People, Managing Task dan Managing Self.

ABSTRACT

This systematic literature review aims to provide an overview of the research related to the soft competency aspects required in industry 4.0 on human capital development. This study used the PRISMA model and included 284 articles from the Scopus, ScienceDirect, and Springerlink databases and three additional report articles with a publication period of 2010 to 2021, which were then selected according to inclusion and exclusion criteria. Thirty-two articles are considered eligible for the further qualitative analysis process. All were analyzed using a content

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analysis approach that three experts carried out. The result of the analysis shows that articles mention 11 aspects of soft competencies. These aspects are leadership, working with people, customer orientation, communication, task & responsibility engagement, decision making, problem-solving, creative & innovative orientation, flexibility & adaptability, learning orientation, emotional resilience, and problem-solving. These eleven aspects are then classified into Managing People, Tasks, and Self Competencies.

INTRODUCTION

Global economic growth shows a significant increase. The rate of economic growth increased from near zero to close to 1% per year in a short period of time (Clark, 2014). Industry 4.0 challenges require quick and responsive answers. The response is in the form of changes in various areas of life, especially in the aspect of human resource development (Faisal & Syam, 2020). To be able to compete globally, an organization needs to prepare human resources who have capabilities that are increasingly specific and relevant to the needs of these changing conditions. It is estimated by experts that Industry 4.0 and related advances along these lines will have a huge effect on social life. This will naturally trigger the manufacturing community to improve their manufacturing settings to address customer needs and maintain a competitive advantage (Oztemel & Gursev, 2020). The age of Industry 4.0 requires organizations to be integrated with information technology developments, for example by digitally integrating operational processes (Ghobakhloo & Fathi, 2019).

Indonesia, through the Ministry of Empowerment of State Apparatus and Bureaucratic Reform, is currently working on a strategy to optimize human resource development through the Talent Management scheme, which aims to accelerate career development, planned succession and ensure the right placement of human resources according to their positions and qualifications (Kencana, 2019). According to the Head of Bappenas National Development Planning Agency), this talent development ecosystem is manifested in the National Talent Management which consistently provides appropriate interventions so that the quality of individual abilities can support the needs of the organization (Sekretariat Kabinet Republik Indonesia, 2021). The Expert Staff of the Minister of Industry for Communication said that there are at least five competencies that need to be developed to realize superior human resources to support the needs of industry 4.0, namely mastery of automation technology, data analysis, AI and soft skills, the ability to behave flexibly. To support this, specifically for the manufacturing sector, the government launched Making Indonesia 4.0 Roadmap as a form of readiness to enter the industrial era 4.0 (Embu, 2019). However, the detailed capabilities of superior human resources to be able to adapt to the needs of industry 4.0 have not been clearly defined.

The need for superior talent encourages the human resource development division within the organization to take on the role of strategic partners in providing

and managing talents who have specific abilities so that they can take advantage of industry 4.0 opportunities (Dhanpat *et al*., 2020). In addition, the human resource development division is also encouraged to have a strategic approach to increase employee capacity and be able to survive the rapidly changing work environment (Hecklau *et al*., 2016). Further, competition between companies in the 4.0 era also gave rise to a "talent war" or talent war. The talent war itself is a phenomenon in the 21st century in the form of competition between organizations and companies to hire and maintain superior human resources (Aguinis *et al*., 2012). For this reason, integration between individual competencies and organizational competencies in the form of organizational culture is needed to win the talent war (Ulrich, 2015).

Changes that occur in the industrial world also make higher education institutions have to work together with industry, professionals, and the government to maintain the quality of their graduates, especially in terms of competence (Hernandez-de-Menendez *et al*., 2020). Millennials and above are a generation that is massively exposed to technological developments and has high demands for creative and innovative work. This needs to be managed properly so that each individual has talent development that is measurable, directed, and has a clear profile of his future career (Kemenpanrb, 2020). It is necessary to identify the congruity between competencies developed in the world of education and competencies required in the professional world. Through this, it is hoped that graduates will be better prepared to work and support organizations in facing changes and challenges of industrial competition.

Competence according to The Organization for Economic Cooperation and Development (Flynn, 2014) is the ability to meet complex demands by utilizing the mobilization of knowledge, skills, and psychosocial resources including skills and attitudes in certain contexts. Competence refers to both visible elements (such as knowledge and skills) and underlying characteristics (such as attitudes, traits, and motives) (Pang *et al*., 2019). In general, competence will affect individual performance which ultimately has an impact on the success of an organization or company. Competence is divided into two types, namely hard competency and soft competency. Hard competency is an individual's ability related to technical matters such as the use of equipment and the ability to manage information (Laker & Powell, 2011). Meanwhile, soft competency is a personal feature owned by an individual consisting of behavior, social skills, performance, and professionalism (Kolibáčová, 2015).

This literature study is to identify the aspects of soft competencies needed to support Industry 4.0. Unlike hard competencies identified in specific fields, this study focuses on identifying soft competencies because this is not related to specific business fields or specific industries. It is hoped that the results of this research can be a useful basis for company's human resource development divisions in formulating strategic steps in the provision and management of human resources. In addition, the results of this study can be a reference for educational institutions in formulating educational curricula and competency development to produce graduates that are in line with the

needs of industry 4.0.

Research question

The research question is based on the needs for the selected topic in the literature review, namely: What are the soft competency aspects needed in industry 4.0?

LITERATURE REVIEW

Industry 4.0

In 2011, experts from various fields from Germany sparked the Industrial Revolution 4.0 at the Hannover Trade Fair. In 2015, Angella Markel introduced the idea of the Industrial Revolution 4.0 at the World Economic Forum (WEF). The industrial era 4.0 is an era where there is a change from a manufacturing process that is dominated by machines to a manufacturing process that is dominated by digital. The 4.0 era also triggers changes that have an impact on social aspects. Oztemel & Gursev (2020) states that there are several aspects in the 4.0 era that have an impact on social aspects, namely the Internet of Things (IoT), machine-to-machine (M2M), and cyber physical systems (CPS). IoT technology allows M2M/machines to communicate so as to produce a work environment that is free from humans. In addition, CPS technology also facilitates communication between machines, resulting in a manufacturing system that is more consistent, robust, and has intelligence capabilities. Because it is no longer enough just to optimize manufacturing processes and machines, it is necessary to empower employees to meet the challenges of the future. Enke *et al*., (2018) stated that there are several characteristics of Industry 4.0, namely using a technological approach, having a philosophy of feasibility and self-optimization, based on adjustments/adaptations and extensive networks, learning based on data, and obtaining information in real time. and based on the specific problem at hand.

Competences

Competition in today's industrial context is getting tougher and competency-based practices are becoming more of a concern. Competence is a construct consisting of various different competency classes, namely technical and methodological, social and communicative oriented to the implementation of skills (Adolph *et al*., 2014). Competence becomes more effective when it is often used for problem solving. In addition, Bermúdez & Juárez (2017) defines competence in the individual aspect as a set of behaviors, abilities, skills, analysis, decision making, and information transmission needed to carry out a position in a job. Kamaruzzaman *et al*. (2018) also state that competence is a personal skill that reflects the potential ability to provide an adequate or consistently high level of performance in certain job functions. Meanwhile, competence is also defined as a collection of skills, abilities and behaviors to solve problems in certain contexts (Pawlowski & Holtkamp, 2012).

Industrial developments that occur will affect the development of

competencies needed to answer the challenges that will be faced by companies, organizations, and individuals themselves. Competence development can be done both outside and inside the work process carried out by individuals. This is supported by technological developments that support the virtual learning process so that it can be more cost and time efficient. Even so, competency management is needed to determine which competencies will be developed, using what methods/approaches, and when they will be developed (Adolph *et al*., 2014). Competency development is especially needed by undergraduate graduates because there is often a gap between their competencies and company needs (Azevedo *et al*., 2012). Therefore, competency development needs to be carried out to keep individual's employability relevant to the industrial developments (De Vos *et al*., 2011).

Competence is defined as an ability (capability or ability), which is a set of behaviors that are related but have different intentions based on motives. Whereas behavior is an alternative manifestation of intention, which is appropriate in various situations or times (Boyatzis, 2008). Competence can be considered as a behavioral approach to emotional, social, and cognitive intelligence that is easy to use to focus attention on the emotional and social components that underlie human talent (Boyatzis, 2011). Competence is divided into two types, namely soft competence and hard competence. According to Tripathi & Agrawal (2014), soft competence is a managerial ability, or individual ability to manage work and develop interactions with other individuals. Meanwhile, hard competence is an ability competence, or individual ability related to the technical matters of a job (Tripathi & Agrawal, 2014). On the other hand, Heckman & Kautz (2012) stated that soft competence predicts success in an individual's life. This is in line with the findings of Aasheim *et al.* (2009) that companies need soft competencies for workers more than hard competencies. Therefore, individuals who have soft competencies that are more prominent have a greater chance of working and are needed by companies and organizations to survive and develop.

A company or organization requires different competencies of different individuals, depending on the position or position of the individual. Kolibácová (2014) classifies positions into four levels based on the strategic competencies required for work, namely upper and middle management, lower management executives, specialists, and professional staff. The competencies needed by individuals at the upper and middle level management positions are seeking profits for the company, leadership skills, the ability to resolve conflicts, provide persuasion and be assertive, and the willingness to make changes. Lower-level management executive positions require initiative competence, commitment, leadership skills, conflict resolution, maintaining quality, persuasiveness, and assertiveness. Meanwhile, specialist positions require initiative competence, commitment, customer focus, team work, persuasiveness, assertiveness, and managing information or knowledge. Lastly, professional staff positions require initiative competence, commitment, ability to

maintain quality, ability to work in a team, focus on customers, and reliablity.

RESEARCH METHODS

This study uses a systematic literature review method to identify the soft competencies needed in the industrial era 4.0. The systematic literature review method examines or critically reviews knowledge, ideas, or findings, and formulates theoretical and methodological contributions to certain topics. By integrating empirical findings from multiple perspectives, a literature review can answer research questions with strengths that other studies lack (Snyder, 2019). In addition, a literature review is an excellent way to combine research findings to reveal areas that require more research which are important components of creating a theoretical framework and building a conceptual model. Systematic literature review seeks to evaluate the state of the literature on a particular topic or research question (RQ). Systematic literature review is a structured approach to research synthesis, following a number of predetermined steps (Boland *et al*., 2017). Systematic literature review is considered the most systematic and acceptable method because it is conducted rigorously and has the potential to hold the strongest data validity. By combining the findings of studies in the field, a systematic literature review makes it possible to (1) provide strong and broad conclusions by producing an unbiased summary of what the cumulative evidence says about a particular topic; (2) critical synthesis of literature in the field so as to identify relationships, contradictions, methodological weaknesses, gaps, and inconsistencies that inform directions for future research; (3) development of new theories or evaluation of existing theories or have clear implications for policy or practice (Siddaway *et al*., 2019).

Search Process

In the search for articles that were included in the literature review analysis process, the PRISMA (Preferred Reporting Items for Systematic Reviews and Metanalysis) model was used. In PRISMA model, there are four stages, namely 1) literature search; 2) the extracting information from research reports is now treated as two separate stages; 3) summarizing and integrating evidence from individual studies; 4) interpreting the cumulative findings that emerged from this analysis.

Article Inclusion and Exclusion Criteria

The inclusion criteria used are English-language journals published in the 2010-2021 range which mention soft competencies and in a special context, namely Industry 4.0. Meanwhile, the exclusion criteria were journals in languages other than English, published before 2010 and discussions about hard competencies, hard skills and technical skills era 4.0 or non-era 4.0 soft competencies.

Table 1
Article Inclusion and Exclusion Criteria

No	Inclusion Criteria	Exclusion Criteria
1	Articles published between 2010-2021	Articles published before 2010
2	Article uses industry 4.0 context	Article does not use industry 4.0 context
3	Article mentions soft competencies	Article mentions competencies in general and does not specifically mention soft competencies

Quality Assessment

Quality control refers to assessment on relevant indexed journals and manuscripts. This involved a team of 2 industrial and organizational experts, and 1 HR professional. At this stage the data were evaluated based on the following questions: QA1: Was the article published in the 2010-2021 timeframe?

QA2: Does the article mention the required soft competencies?

QA3: Does the article discuss competence in the context of industry 4.0 needs?

And each article was given a score based on the statement above and marked "Yes" or "No" accordingly.

Data Collection

Sources of data used in this study were research journals, books and other secondary data published in 2010-2021 using the Scopus, Sciendirect, Springerlink databases. The keywords used for the search include competencies, personalities, characters, 4.0, industry 4.0, 4.0 era, employee, human resources.

Data Analysis

To answer the research questions, the data analysis was carried out using content analysis. Content analysis is commonly used in both quantitative and qualitative literature studies to produce descriptive findings and the results can be reviewed contextually. Content analysis is a systematic approach with the following steps: (a) coding, (b) code grouping based on similarities, and (c) data abstraction. The results of the analysis were then validated by peer-review where the checking involved 3 experts, two of whom were academics in industry and organizations, while 1 person was a professional in the field of HRD.

ANALYSIS AND DISCUSSION

The following is the process of identifying literature sources using the PRISMA (Preferred Reporting Items for Systematic Reviews and Metanalyses) provisions.

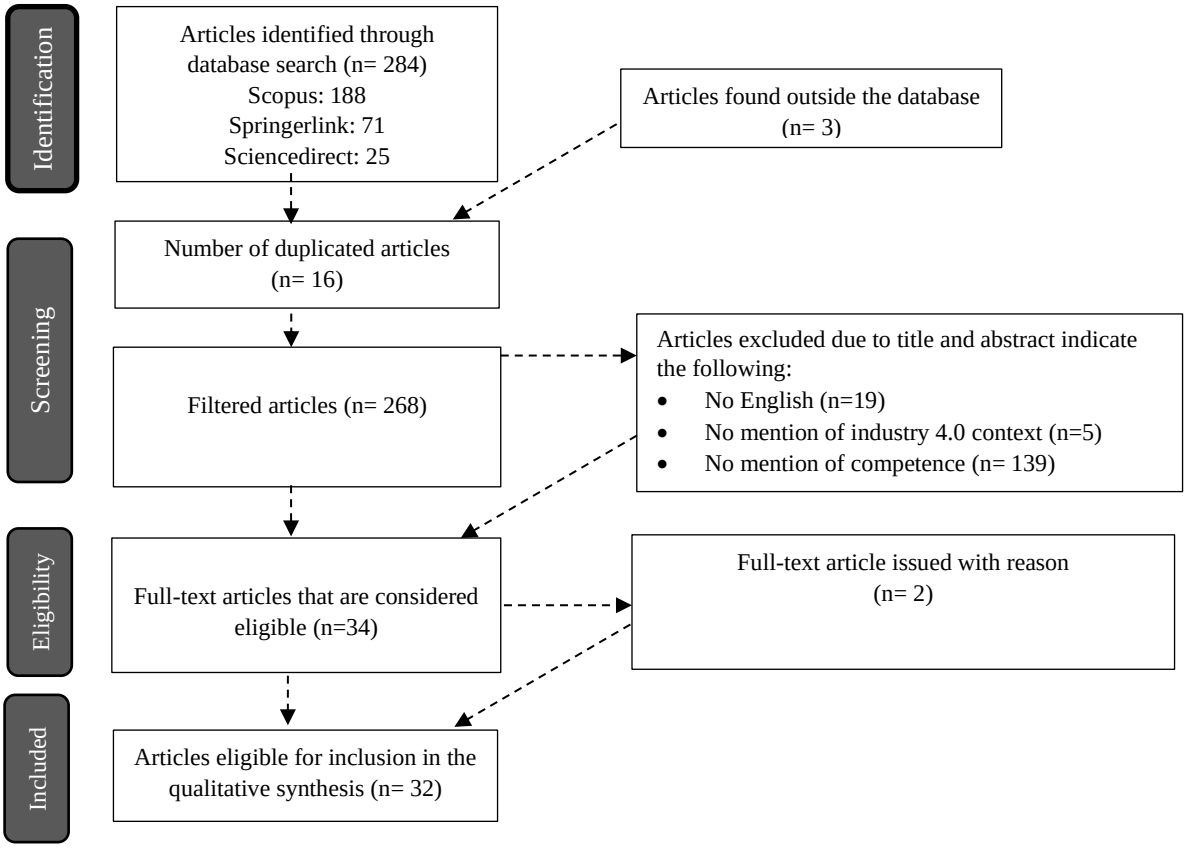

Figure 1
PRISMA Flowchart of Systematic Literature Review Process for Identification of Soft Competenties Aspects in Human Resource Development Industry 4.0

Search Process and Quality Assessment Results

The search process carried out in the early stages resulted in 284 journal literature and conference proceedings that had gone through a peer-reviewed process. The results were then filtered to remove 16 literatures that were identified as duplications. On the other hand, there were 3 reports that were added because they were not captured in the database but considered relevant. A total of 268 literatures were filtered by title, abstract and keywords. There were 163 literatures that were excluded with strong reasons, namely not using English, not mentioning competence, and not in the context of industry 4.0. There were 34 remaining literatures which then undergo the Quality Assessment process.

Table 2
Articles Included in the Analysis Process

Article No.	Reseacher	Year	Title	Source	Article Type	Type of Study	Type of Respondent	Location of Study
1	Pawlowski, J. M., & Holtkamp, P.	2012	Towards an internationalization of the	Multikonferenz Wirtschaftsinformatik 2012 - Tagungsband Der	Proceeding	Quantitative	Higher Education Teachers / Researche	Finlandia

Article No.	Reseacher	Year	Title	Source	Article Type	Type of Study	Type of Respondent	Location of Study
			information systems curriculum.	MKWI 2012, June, 437–449.			rs, Students, Professionals	
2	Fattahi, B., Milanovich, N., Howes, S., Paccaloni, G., & Brett, F.	2014	Soft competency development as a global challenge.	Journal of Petroleum Technology, 66(10), 136–141. https://doi.org/10.2118/1014-0136-jpt	Journal	Literature Review	Employee	Australia
3	Lorenz, M., Rüßmann, M., Strack, R., Lueth, K. L., & Bolle, M.	2015	Man and Machine in Industry 4.0.	Man and Machine in Industry 4.0. Boston Consulting Group, 18.	Report article	Quantitative	Workers from differences industries	-
4	Hecklau, F., Galeitzke, M., Flachs, S., & Kohl, H.	2016	Holistic Approach for Human Resource Management in Industry 4.0.	Procedia CIRP, 54, 1–6. https://doi.org/10.1016/j.procir.2016.05.102	Proceeding	Qualitative	-	Germany
5	Zahidi, S., Ratcheva, V., Hingel, G., & Brown, S.	2020	The 10 skills you need to thrive in the fourth industrial revolution.	World Economic Forum, Cologny, Switzerland.	Report article	Quantitative	Employee	Geneva Switzerland
6	Cotet, G. B., Balgiu, B. A., & Negrea, V. C. Z.	2017	Assessment procedure for the soft skills requested by Industry 4.0.	MATEC Web of Conferences, 121, 1–8. https://doi.org/10.1051/matecconf/201712107005	Proceeding	Literature Review	-	Romania
7	Grzybowska, K., & Łupicka, A.	2017	Key competencies for Industry 4.0.	Economics and Management Innovations (ICEMI), 1(March 2018), 250–253. https://doi.org/10.26480/icemi.01.2017.250.253	Journal	Quantitative	Manager	Poland
8	Bermúdez, M. D., & Juárez, B. F.	2017	Competencies to adopt Industry 4.0 for	Proceedings of the International Conference on Industrial Engineering and	Proceeding	Qualitative	Manager	Colombia

Article No.	Reseacher	Year	Title	Source	Article Type	Type of Study	Type of Respondent	Location of Study
			operations management personnel at automotive parts suppliers in Nuevo Leon.	Operations Management, 2017(OCT), 736–747.				
9	Prifti, L., Knigge, M., Kienegger, H., & Krcmar, H.	2017	A Competency Model for "Industrie 4.0" Employees.	13th International Conference on Wirtschaftsinformatik, 46–60.	Proceeding	Qualitative	-	Germany
10	Karre, H., Hammer, M., Kleindienst, M., & Ramsauer, C.	2017	Transition towards an Industry 4.0 State of the Lean Lab at Graz University of Technology.	Procedia Manufacturing, 9, 206–213. https://doi.org/10.1016/j.promfg.2017.04.006	Proceeding	Qualitative	-	Austria
11	Łupicka, A., & Grzybowska, K.	2018	Key Managerial Competencies for Industry 4.0 - Practitioners', Researchers' and Students' Opinions.	Logistics and Transport, 39(3), 39–46. https://doi.org/10.26411/83-1734-2015-3-39-4-18	Journal	Quantitative	Experts nad students	Poland
12	Wang, B., & Ha-Brookshire, J. E.	2018	Exploration of Digital Competency Requirements within The Fashion Supply Chain with	International Journal of Fashion Design.	Journal	Quantitative	Employees	USA

Article No.	Reseacher	Year	Title	Source	Article Type	Type of Study	Type of Respondent	Location of Study
			An Anticipation of Industry 4.0.					
13	Ana, A., Meirawan, D., Dwiyanti, V., & Saripudin, S.	2018	Character of industrial 4.0 skilled workers	International Journal of Engineering and Technology(UAE), 7(4), 166–170. https://doi.org/10.14419/ijet.v7i4.33.23524	Journal	Qualitative	-	Indonesia
14	Deloitte Development.	2018	The Fourth Industrial Revolution is here—are you ready?	Deloitte Insights, January 22.	Report article	Quantitative	C-level executives	Americas, Asia and Europe
15	Fitsilis, P., Tsoutsa P., & Gerogiannis, V.		Industry 4.0: Required personnel competences	International Scientific Journal "Industry 4.0"	Journal	Literature Review	-	Greece
16	Cicek, K., Akyuz, E., & Celik, M.	2019	Future Skills Requirements Analysis in Maritime Industry.	Procedia Computer Science, 158, 270–274. https://doi.org/10.1016/j.procs.2019.09.051	Proceeding	Qualitative	-	Turkey
17	Lubis, A. S., Absah, Y., & Lumbanraja, P.	2019	Human resource competencies 4.0 for generation z.	European Journal of Human Resource Management Studies, 3(1), 95–105. https://doi.org/10.5281/zenodo.3375458	Journal	Quantitative	Undergraduate students	Indonesian
18	Maisiri, W., Darwish, H., & VanDyk, L.	2019	An investigation of industry 4.0 skills requirements.	South African Journal of Industrial Engineering, 30(3), 90–105.	Journal	Literature Review	-	South Africa
19	Uys, J., & Webber-Youngman, R.	2019	A 4.0 leadership model postulation for the Fourth Industrial	Journal of the Southern African Institute of Mining and Metallurgy, 119(10), 793–800. https://doi.org/10.1	Journal	Qualitative	-	South Africa

Article No.	Reseacher	Year	Title	Source	Article Type	Type of Study	Type of Respondent	Location of Study
			Revolution relating to the South African mining industry.	7159/2411-9717/17/450/2019				
20	Flores, E., Xu., X., & Lu, Y.	2019	Human Capital 4.0: a workforce competence typology for Industry 4.0	*Journal of Manufacturing Technology Management Vol. 31 No. 4, 2020 pp. 687-703*	Journal	Literature Review	-	New Zealand
21	Peijic-Batch, M., Bertoncel, T., Mesko, M., & Krstic, Z.	2019	Text mining of industry 4.0 job advertisements	International Journal of Information Management	Journal	Quantitative (Machine Learning Analysis)	-	Croatia
22	Cotet, G. B., Carutasu, N. L., & Chiscop, F.	2020	Industry 4.0 diagnosis from an imillennial educational perspective	Education Sciences, 10(1). https://doi.org/10.3390/educsci10010021	Journal	Quantitative	Undergratuade students	Romania
23	Guzman, V. E., Muschard, B., Gerolamo, M., Kohl, H., & Rozenfeld, H.	2020	Characteristics and Skills of Leadership in The Context of Industry 4.0	Procedia Manufacturing, Volume 43, 543-550, https://doi.org/10.1016/j.promfg.2020.02.167.	Proceeding	Literature Review	-	Brazil
24	Hernandez-de-Menendez, M., Morales-Menendez, R., Escobar, C. A., & McGovern, M.	2020	Competencies for Industry 4.0.	*International Journal on Interactive Design and Manufacturing*, *14*(4), 1511–1524. https://doi.org/10.1007/s12008-020-00716-2	Journal	Qualitative	-	Mexico
25	Jerman, A., Bertoncelj. A., Dominici,	2020	Conceptual Key Competency Model	Organizacija, Sciendo, vol. 53(1), pages 68-79, February.	Journal	Qualitative	Experts	Italy

Article No.	Reseacher	Year	Title	Source	Article Type	Type of Study	Type of Respondent	Location of Study
	G., Bach, M. P., & Trnavcevic, A.		for Smart Factories in Production Processes					
26	Weerasinghe, W. P. T. D., Vidanagamachchi, K., & Nanayakkara, L. D. J. F.	2020	Employee competencies development framework for industry 4.0 adaptation in the healthcare sector.	Proceedings of the International Conference on Industrial Engineering and Operations Management, 0(March), 1063–1075.	Proceeding	Literature Review	-	Sri Lanka
27	Tan, H. Sen, Ivander, Oktarina, R., Reynaldo, V., & Sharina, C.	2020	Conceptual development of learning factory for industrial engineering education in Indonesia context as an enabler of students' competencies in industry 4.0 era.	IOP Conference Series: Earth and Environmental Science, 426(1), 0–10. https://doi.org/10.1088/1755-1315/426/1/012123	Proceeding	Qualitative	-	Indonesia
28	Brezeanu, T., M & Lazarou, E.	2020	Alignment between engineering curriculum and skills development for industry 4.0	The 16th International Scientific Conference eLearning and Software for Education Bucharest, April 23-24, 2020 10.12753/2066-026X-20-127	Proceeding	Literature Review	-	Romania
29	Jorge, J. M., de Oliveira, A., C., A., & dos	2020	Analyzing How University Is Preparing	Conference: Volume 12: Transdisciplinary Engineering for Complex Socio-	Proceeding	Qualitative	Undergraduate Students &	Brasilia

Article No.	Reseacher	Year	Title	Source	Article Type	Type of Study	Type of Respondent	Location of Study
	Santos A., C.		Engineering Students for Industry 4.0	technical Systems – Real-life Applications			Professors	
30	Alharbi, O.	2020	Industry 4.0 Operators: Core Knowledge and Skills	Technology and Engineering Systems Journal Vol. 5, No. 4, 177-183 (2020). https://dx.doi.org/10.25046/aj050421	Journal	Qualitative	Experts from difference industries	Saudi Arabia
31	Pattanapairoj, S., Nitisiri, K., & Sethanan, K.	2021	A Gap Study between Employers' Expectations in Thailand and Current Competence of Master's Degree Students in Industrial Engineering under Industry 4.0	Production Engineering Archives 2021, 27(1), 50-57. DOI: 10.30657/pea.2021.27.7	Journal	Mixed qualitative and quantitative research	Experts from difference industries	Thailand
32	Ada, N., Ilic, D., & Sagnak, M.	2021	A Framework for New Workforce Skills in the Era of Industry 4.0	International Journal of Mathematical, Engineering and Management Sciences Vol. 6, No. 3, 771-786, 2021 https://doi.org/10.33889/IJMEMS.2021.6.3.046	Journal	Mixed qualitative and quantitative research	Human Resource Manager	Turkey
33	Bianco, D., Filho, M., G., Osiro, L., & Ganga, G., M., D.	2021	Unlocking the Relationship Between Lean Leadership Competencies and Industry 4.0 Leadership	IEEE Transactions on Engineering Management	Journal	Mixed qualitative and quantitative research	Experts from difference industries	Brighton

Article No.	Reseacher	Year	Title	Source	Article Type	Type of Study	Type of Respondent	Location of Study
			Competencies: An ISM/Fuzzy MICMAC Approach					
34	Al Amri, Khetani, K., P., & Marey-Perez, m.	2021	Towards Sustainable I4.0: Key Skill Areas for Project Managers in GCC Construction Industry	Sustainability 2021, 13, 8121. https://doi.org/10.3390/su13158121	Journal	Quantitative	Manager	Spain

Two literatures (article no. 15 and article no. 30) were excluded during the Quality Assessment process as these articles do not state soft competencies according to the criteria, so it was considered inadequate for the research purpose. The following table can explain the results of the Quality Assessment assessment.

Table 3
***Quality Assessment* Artikel**

Article No.	Researcher	QA1	QA2	QA3	QA Result
1	Pawlowski, J. M., & Holtkamp, P.	Yes	Yes	Yes	Accepted
2	Fattahi, B., Milanovich, N., Howes, S., Paccaloni, G., & Brett, F.	Yes	Yes	Yes	Accepted
3	Lorenz, M., Rüßmann, M., Strack, R., Lueth, K. L., & Bolle, M.	Yes	Yes	Yes	Accepted
4	Hecklau, F., Galeitzke, M., Flachs, S., & Kohl, H.	Yes	Yes	Yes	Accepted
5	Zahidi, S., Ratcheva, V., Hingel, G., & Brown, S.	Yes	Yes	Yes	Accepted
6	Cotet, G. B., Balgiu, B. A., & Negrea, V. C. Z.	Yes	Yes	Yes	Accepted
7	Grzybowska, K., & Łupicka, A.	Yes	Yes	Yes	Accepted
8	Bermúdez, M. D., & Juárez, B. F.	Ya	Ya	Ya	Diterima
9	Prifti, L., Knigge, M., Kienegger, H., & Krcmar, H.	Yes	Yes	Yes	Accepted
10	Karre, H., Hammer, M., Kleindienst, M., & Ramsauer, C.	Yes	Yes	Yes	Accepted
11	Łupicka, A., & Grzybowska, K.	Yes	Yes	Yes	Accepted
12	Wang, B., & Ha-Brookshire, J. E.	Yes	Yes	Yes	Accepted
13	Ana, A., Meirawan, D., Dwiyanti, V., & Saripudin, S.	Yes	Yes	Yes	Accepted
14	Deloitte Development.	Yes	Yes	Yes	Accepted
15	Fitsilis, P., Tsoutsa P., & Gerogiannis, V.	Yes	No	Yes	Rejected
16	Cicek, K., Akyuz, E., & Celik, M.	Yes	Yes	Yes	Accepted
17	Lubis, A. S., Absah, Y., & Lumbanraja, P.	Yes	Yes	Yes	Accepted
18	Maisiri, W., Darwish, H., & VanDyk, L.	Yes	Yes	Yes	Accepted

Article No.	Researcher	QA1	QA2	QA3	QA Result
19	Uys, J., & Webber-Youngman, R.	Yes	Yes	Yes	Accepted
20	Flores, E., Xu., X., & Lu, Y.	Yes	Yes	Yes	Accepted
21	Peijic-Batch, M., Bertoncel, T., Mesko, M., & Krstic, Z.	Yes	Yes	Yes	Accepted
22	Cotet, G. B., Carutasu, N. L., & Chiscop, F.	Yes	Yes	Yes	Accepted
23	Guzman, V. E., Muschard, B., Gerolamo, M., Kohl, H., & Rozenfeld, H.	Yes	Yes	Yes	Accepted
24	Hernandez-de-Menendez, M., Morales-Menendez, R., Escobar, C. A., & McGovern, M.	Yes	Yes	Yes	Accepted
25	Jerman, A., Bertoncelj. A., Dominici, G., Bach, M. P., & Trnavcevic, A.	Yes	Yes	Yes	Accepted
26	Weerasinghe, W. P. T. D., Vidanagamachchi, K., & Nanayakkara, L. D. J. F.	Yes	Yes	Yes	Accepted
27	Tan, H. Sen, Ivander, Oktarina, R., Reynaldo, V., & Sharina, C.	Yes	Yes	Yes	Accepted
28	Brezeanu, T., M & Lazarou, E.	Yes	Yes	Yes	Accepted
29	Jorge, J. M., de Oliveira, A., C., A., & dos Santos A., C.	Yes	Yes	Yes	Accepted
30	Alharbi, O.	Yes	No	Yes	Rejected
31	Pattanapairoj, S., Nitisiri, K., & Sethanan, K.	Yes	Yes	Yes	Accepted
32	Ada, N., Ilic, D., & Sagnak, M.	Yes	Yes	Yes	Accepted
33	Bianco, D., Filho, M., G., Osiro, L., & Ganga, G., M., D.	Yes	Yes	Yes	Accepted
34	Al Amri, Khetani, K., P., & Marey-Perez, m.	Yes	Yes	Yes	Accepted

Data Analysis

After going through the article eligibility selection stage, a content analysis was carried out. The initial stage of the analysis is to describe and code each soft competency mentioned in each article. Then the next stage is code classification process based on similarities and then abstraction. This process was carried out by 2 experts, and when there was a difference of opinion regarding the coding and classification of codes, the third expert gave his decision. The following table shows the identification and classification of soft competencies mentioned in each analyzed article.

Table 4
Identified Competencies of the Articles Under Review

No	Broad Competencies	Specific Competencies	Article No
1	Leadership	Leadership, Initiatively taking a lead, Leadership skills, Project Management and Leadership, Leadership Capability, Leading and supervising, People Management, Management of personnel resources	1, 2, 4, 5, 9, 11, 13, 16, 17, 18, 26, 33 (n=12)

No	Broad Competencies	Specific Competencies	Article No
2	Working with others	Collaboration with external relations, Intercultural competences, Teamwork, Collaborating with others, Adapting to cultural differences, Ability to compromise and cooperate, Coordinating with Others, Cooperation skills, Collaboration, Perspective-taking, Understanding of diversity, Intercultural skills, Teamwork awareness, Compromising, Creating Business Networks, Negotiating, Work in Interdisciplinary Environments, Team work abilities, Social skills	1, 2, 3, 4, 5, 6, 8, 9, 10, 13, 14, 16, 17, 18, 20, 23, 26, 27, 29, 31, 33 (n=21)
3	Communication	Effective Communication, Dialogue and conversation, Communication, Speaking, Active listening, Writing, Reading comprehension, Language skills, Communication skills, Communication, Language ability, Communication with people, Technical and literate communication, Presentation and Communication Ability, Targeted/Technical Communication, Communication skills	1, 2, 4, 6, 9, 10, 11, 16, 17, 18, 23, 27, 31, 33 (n=14)
4	Customer & Service Orientation	Service Orientation, Being able to understand global partners and customers, Maintaining Customer Relationships, Customer Orientation, Customer Relationship Management	4, 5 , 9, 13, 26 (n=5)
5	Responsibility	Goal orientation, Responsibility for careers, Personal achievement, Goal setting, Pride in productivity, Systems, structures, and processes, Result Orientation, Professionalism, accountability, Self-management, Responsibility, Taking Responsibility, Individual Responsibility	2, 9, 10, 17, 18, 22, 23 32, 33, 34 (n=10)
6	Decision Making	Establishing direction, Conflict Solving, Decision Making, Decision making, Reasoning and Decision making, Judgement and Decision Making, Quality decision making, Decision making under pressure	2, 4, 5, 7, 9, 16, 17, 23, 24, 26, 28, 31 (n=12)
7	Creative & Innovative Orientation	Thinking outside of the box, Creativity, Innovation, and imagination, Critical thinking, Creative & innovative orientation, Visioning, Entrepreneurial thinking, Entrepreneur Capability, Creativity in designing strategies to introduce new practices, Creating and Innovating, Sustainable mind-set, Business thinking, Creativity in designing strategies to introduce new practices Ability to adopt new models of work and organization (open to change), Strategic agility and business acumen	2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 28, 31, 32, 34 (n=24)

No	Broad Competencies	Specific Competencies	Article No
8	Flexibility & Adaptibility	Flexibility, Adaptability, Ambiguity tolerance, Flexibility / Adaptation to Change, Adaptive thinking, Environmental awareness, Legislation awareness, Cognitive Flexibility, Able to manage change, Change Management, Managing Complexity, Adaptability and Ability to Change Mind-set, Dynamic, Evolution, Revolution, Adaptability/ ability to change, Strategic Agility	2, 3, 4, 5, 6, 8, 9, 10, 14, 16, 17, 18, 22, 25, 26, 27, 34 (n=17)
9	Learning Orientation	Educational purpose, Research Skills, Active learning, Research skills, Motivation to learn, Openness to Learning, Organizational Learning, Encourage constant learning, Have a rapid learning process, Ability to generate new management practices, Learning and Researching, Update Knowledge, Lifelong learning skills, Experimantation, Recognition of the need for lifelong learning, Self-knowledge, Literacy, Continuous improvement & lifelong learning	4, 7, 8, 9, 16, 17, 18, 22, 23, 24, 25, 27, 32 (n=13)
10	Emotional Resilience	Positive attitude, Confidence in success, Fearlessness, Competitiveness, Assertiveness, Optimism, Happiness, Self-actualization, Self-Powers, Emotional intelligence, Patience, Self-confidence, Stress management, Ability to work underpressure, Self-recognition, Self-regulation, Self-awareness	2, 4, 5, 6, 9, 14, 16, 18, 22, 26, 27, 33 (n=12)
11	Problem Solving	Problem solving, Critical thinking, Solution appraisal, Conflict solving, Analytical Skills, Identification of key causes, Problem Identification, Cognitive ability, Complex Problem Solving, Critical and logical thinking, Trouble-shooting.	2, 4, 5, 7, 9, 11, 12, 16, 17, 18, 22, 23, 24, 28, 33 (n=15)

The following graph can explain the distribution of the competencies and the frequency each is mentioned in all analyzed articles.

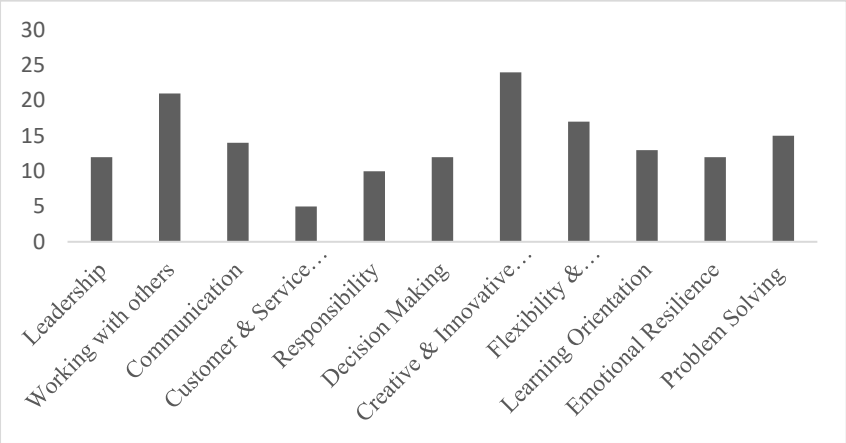

Figure 1
Distribution and frequency in each competency

From the graph above, it can be seen that three soft competencies that are mentioned most often in the articles analyzed are creativity and innovative orientation, working with others, and flexibility & adaptability. Meanwhile, the two least mentioned soft competencies are customer & service orientation, and responsibility. Creativity and innovation are needed in industry 4.0 as it is the key to the success and sustainability of an industry. Industrial Revolution 4.0 is characterized by efficiency in the exchange of information. At this stage, individual creativity is needed to develop a system capable of performing such efficiency (Sima *et al*., 2020). In addition to creativity and innovation, the most important thing needed in industry 4.0 is collaborative work. The use of collaborative networks in the context of industry 4.0 can help companies achieve higher market responsiveness to be more profitable (Brettel *et al*., 2014). Giving team members the freedom to collaborate through the use of innovative and intuitive technology enables alignment between teams and helps organizations maintain a cohesive business vision. Collaboration among all stakeholders along the business process chain, including collaborating with business partners and customers, is also a required of an organization to face industry 4.0. Collaboration in the business ecosystem, that is between organizations, is an effort to build strategic alliances. This collaboration includes the sharing of resources and information (Camarinha-Matos *et al*., 2017). In industry 4.0 era, individuals are also likely to be involved in the entire production system, both in their roles as system designers, as workers, and as users of the things produced (Kinzel, 2017). Therefore, flexibility is needed to deal not only with complex roles, but also with disruptive environmental changes.

In the process of data abstraction, the eleven competencies found above were then grouped into 3 major groups, namely groups of task-related competencies, people-related competencies, and self-related competencies, which is in accordance with the concept of required managerial competencies (Smutny *et al*., 2014). This group division also refers to that suggested by Analoui (1990) where there are three

important categories, namely task-related competencies, people-related competencies and self-related competencies, which play an important role in improving effectiveness of senior managers in both private and public sector organizations.

Task-related competencies are the ability to carry out the process of identifying, setting priorities, planning, and monitoring and solving various problems related to various tasks within one's responsibilities that need to be carried out within a period of time. People-related competencies are the ability to understand the needs of others, build interactions, mobilize and direct others to build relationships in order to support productivity. Meanwhile, self-related competencies are one's ability to manage actions, be responsible for changes in behavior, and develop self-ability by using certain skills so that he/she is able to obtain what he/she wants to achieve. The following is the division of soft competencies and definitions of each as recommended in the analyzed articles.

Table 5
Division of aspects and definition of each competency

Orientation	Soft Competencies	Definition
People-related competencies	Leadership	The ability of a person to influence, direct, motivate and supervise others to complete tasks that have been planned to achieve certain goals.
	Working with people	A person's desire to work collectively by showing a willingness to share responsibilities and open oneself to accept ideas from others as well as a desire to share collaboration spaces to achieve the same goal.
	Customer Orientation	One's ability to meet customer needs proactively by recognizing needs, establishing good relationships, and continuously improving service quality.
	Communication	The ability to choose appropriate and effective communication behavior according to the context of the situation so as to have the effect of achieving a common understanding with the communication partner.
Task-related competencies	Task Engagement & Responsibility	A person's ability to find ways to get involved in a task, whether he likes it or not, so that he can complete it to completion with adequate results.
	Decision Making	A person's ability to make choices by identifying decisions, gathering information, and assessing alternative resolutions in order to obtain more appropriate decisions.
	Problem Solving	The ability to recognize problems, create solving strategies and then apply the knowledge and skills possessed to answer problems.
	Creative & Innovative Orientation	The ability to use new information and previous knowledge, synthesize ideas, evaluate the effectiveness of existing ideas, and generate new ideas that are considered more capable of answering problems

Orientation	Soft Competencies	Definition
Self-related competencies	Flexibility & Adaptibility	The ability to change oneself according to circumstances so that it can survive and continue to develop even though it is in changing conditions and moves dynamically.
	Learning Orientation	A person's ability to improve knowledge and skills and think critically in responding to changes and challenges that exist through continuous improvement actions.
	Emotional Resilience	The capacity of individuals to realize, express and control their emotions so that they are able to appropriately choose actions that are appropriate to the situation at hand and survive under pressure.

CONCLUSION, LIMITATIONS, AND SUGGESTIONS

There are several competencies that individuals need in order to survive and compete in the 4.0 era. Based on the research results, it can be concluded that based on the results of the Systematic Literature Review or SLR, there are 11 aspects of soft competence that are relevant to the needs of industry 4.0, namely leadership, working with people, customer orientation, communication, task engagement & responsibility, decision making, problem solving, creative & innovative orientation, flexibility & adaptability, learning orientation, emotional resilience. The limitation of this research is that this study cannot cover all publications related to soft competencies that may exist and have been published. The included studies were limited to certain databases, were open-access, and did not include gray literature that was not published by commercial or academic publishers. This has limited the number of manuscripts that were analyzed. In addition, language barriers are a major problem for conducting this type of systematic literature review, because the included manuscripts were only those available in English. It is suggested that further research re-confirm the results obtained through other methods such as focus group discussions or deep interviews with experts to ensure that these aspects are in accordance with the conditions in the field. In addition, more specific research can be conducted on the competencies required by certain positions or industries. Research can also be done on competencies that are no longer needed in the 4.0 era and in the next era.

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